National Institute of Environmental Health Sciences

A GIS framework for the assessment of tick impact on human health in a changing climate

Author(s): Estrada-Peña A
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Abstract:

A framework to evaluate the impact of ticks on human health under various scenarios of climate change is proposed. The purpose is not to provide a comprehensive plan (e.g. the economic impact of ticks on human society is not included), instead we wish to describe a series of indices that would be helpful by obtaining homogeneous comparisons of impact and vulnerability exerted by ticks in different regions, countries or continents, using normalized sets of population, vegetation, climate and physical attributes of the territory. Three tick species, i.e. Dermacentor marginatus, Rhipicephalus turanicus and Hyalomma marginatum, have been traced over the territory of Spain to further explain the computation of these indices. The discussion is based on tick habitat suitability, used as a measure of the abiotic (climate) fitness of the habitat for the species in question, and the sensitivity of each tick species to the rate of change of habitat suitability with respect to climate change. The impact is the rate of change in habitat suitability weighted with a fuzzy logic function evaluating the total number of people in an area, percent of rural population and accessibility of the geographical divisions (expressed as hexagons with a 10 km radius) used in the study. The different climate scenarios evaluated in relation to ticks show that the north-western part of Spain would suffer the greatest impact in case the mean temperature would increase, while the Mediterranean region would suffer the highest impact if temperatures decreased. Vulnerability, based on the sanitary structure of the territory and on the impact on human activities due to the change in tick distribution and abundance, is proposed as a measure of adaptation of society to these climate scenarios. The cost is evaluated as a function of land use and tick habitat suitability in a buffer zone surrounding each geographic division. All indices proposed have been obtained by search of common and/or publicly available data sets.

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Other Climate Scenario

Other Climate Scenario: author defined scenarios of increases/descreses in temp and precip

Early Warning System:

resource focus on systems used to warn populations of high temperatures, extreme weather, or other elements of climate change to prevent harm to health

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Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Precipitation, Temperature

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Europe

European Region/Country: European Country

Other European Country : Spain

Health Impact:

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Vectorborne Disease

Vectorborne Disease: Tick-borne Disease

Tick-borne Disease: General Tick-borne Disease

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology:

type of model used or methodology development is a focus of resource

Exposure Change Prediction, Methodology

Resource Type:

format or standard characteristic of resource

Research Article, Research Article

Timescale:

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

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